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⑯ Apparatus for controlling the loading of workpieces onto a pallet

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Description**BACKGROUND OF THE INVENTION**

The present invention relates to an apparatus for managing the loading onto a pallet of a plurality of types of workpieces.

An example of such an automatic loading management apparatus is disclosed in Japanese Patent Laid-Open No. 61-33426. The known automatic loading management apparatus prepares a plurality of types of workpiece loading patterns for the automatic loading of a plurality of types of workpieces.

However, this known automatic loading management apparatus is particularly intended to handle a multitude of workpieces and hence is too large in size and complicated in construction, so it is too expensive for small- or medium-scale loading operations.

SUMMARY OF THE INVENTION

Accordingly, the present invention is intended to obviate the above-described problems and has for its object the provision of a loading management apparatus which is small in size, simple in structure and inexpensive to manufacture, and hence is particularly suitable for handling a relatively small number of workpieces.

Another object of the present invention is to provide a loading management apparatus which is able to perform the loading of workpieces with a predetermined loading pattern in an efficient manner.

In order to achieve the above objects, according to the present invention, there is provided a loading management apparatus for managing the loading of a plurality of types of workpieces onto a pallet, the apparatus comprising:

instruction means for preparing a workpiece loading pattern based on given loading information and for providing a loading instruction in the form of a visual image based on the thus prepared workpiece loading pattern;

loading condition detecting means for detecting the condition of the workpieces which are loaded onto the pallet according to the loading instruction of the instruction means;

a control unit being operable to determine whether there is disagreement between the loading instruction of the instruction means and the loading condition of the workpieces detected by the loading condition detecting means; and

warning means being operated by the control unit to provide a warning of disagreement when the control unit determines that there is disagreement between the loading instruction and the detected loading condition.

Preferably, the loading management apparatus further comprises display means for displaying the

loading instruction of the instruction means so that an operator can load the workpieces onto the pallet while looking at the visual image of the loading instruction displayed at the display means.

The display means further operates to display the loading condition of the workpieces detected by the loading condition detecting means during the time the loading instruction is being provided by the instruction means.

With the loading management apparatus as constructed above, the operator can load the workpieces onto the pallet in a predetermined pattern with extreme ease in accordance with the imaged loading instruction of the instruction means, and the condition of the loaded workpieces is displayed at the display means. If there is an error or disagreement in loading, the operator is immediately warned of such an error so that he or she can take appropriate action for proper or correct loading.

The above and other objects, features and advantages of the present invention will become apparent from the following detailed description of a preferred embodiment of the invention taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a plan view of the conceptional overall arrangement of an embodiment of a loading management apparatus in accordance with the present invention;

Fig. 2 is a plan view of the embodiment; Figs. 3 and 4 are front elevations, on an enlarged scale, of an instruction means of Fig. 1, respectively showing different operating states thereof; Fig. 5 is a conceptional circuit diagram of the Fig. 1 embodiment, showing somewhat concrete electrical connections between various component elements; and

Fig. 6 is a flow chart showing the operation of the Fig. 1 embodiment.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The present invention will now be described in detail with reference to a preferred embodiment thereof as illustrated in the accompanying drawings.

Referring first to Fig. 1, a loading management apparatus according to the present invention includes a control unit 9 which stores a loading-pattern preparation program for preparing an appropriate loading pattern based on an input of loading information 7, and a disagreement detection program which will be described in detail later with reference to Fig. 8, a display means 10 for providing an operator 6 with a visual instruction for loading workpieces 1a through 4a onto a specific pallet 5, a loading condition detecting

means 8 in the form of a vision sensor for detecting the condition of the workpieces loaded on the pallet 5, an instruction means 11 for inputting the detected condition of the loaded workpieces to the instruction means 11, and a warning means 12 for generating a warning when a disagreement between the loading instruction of the instruction means 10 and the detected condition of the loaded workpieces exists. The workpieces 1a through 4a are stored in appropriate locations 1 through 4 according to their type which is construed, in the present invention, as including kind, size, shape, weight, and the like. For example, as shown in Fig. 1, the workpieces 1a through 4a are stored in separate locations according to their size.

As shown in Fig. 5, the control unit 9 comprises an input/output (I/O) port 9a for receiving loading information 7 from the outside and the output signal of the loading condition detecting means 8 as well as for sending various instruction signals to the display means 10, the instruction means 11 and the warning means 12, and a microcomputer 9e including a random access memory (RAM) 9b for storing the loading-pattern preparation program, the disagreement detection program, temporary data and the like, a central processing unit (CPU) 9c, and a read only memory (ROM) 9d. The loading-pattern preparation program stored in the RAM 9b has no particular importance in the present invention and may be any kind of known program for preparing a loading pattern for loading workpieces onto a pallet.

The operation of the loading management apparatus as constructed above will now be described with reference to a flow chart of Fig. 6.

Specifically, a pallet 5 is first located in place, and loading information 7 is input to the control unit 9 which then generates a loading command in accordance with the loading information 7 in Step 101. Subsequently in Step 102, based on the loading command from the control unit 9, the instruction means 11 automatically prepared an appropriate loading pattern which is then sent to the display means 10 which displays a loading instruction in the form of a pattern image, as shown in Fig. 3. Looking at this loading instruction thus displayed, the operator 6 can readily load a required number of workpieces for each kind or size as instructed in a predetermined pattern without needing his or her own judgements on these matters. In the course of such loading operation, the loading condition of workpieces is detected by the loading condition detecting means 8 in Step 103, and then in Step 104, the detected loading condition is fed back to the control unit 9 and displayed in the form of a pattern image at the display means 10 through the action of the instruction means 11, as illustrated in Fig. 4, this pattern image being the same as that of Fig. 3 except for the color of the loaded workpieces being changed from that of the remaining unloaded ones. Subsequently in Step 105, it is determined whether

5 there is disagreement between the loading instruction and the detected loading condition of the workpieces. If disagreement exists, the warning means 12 is actuated to warn the operator 6 of such disagreement in Step 106. With this warning, the operator (6) modifies his loading operation so as to eliminate the disagreement. During the course of modifying the loading operation, Steps 103 through 105 are again repeated. On the other hand, if there is no disagreement, the process proceeds to Step 107 where it is determined whether the loading onto the pallet 5 of the workpieces has been completed. If not, Steps 103 through 107 are repeated. In this manner, with the apparatus of a very simple construction, the operator 6 is able to readily load various kinds of workpieces onto the pallet 5.

20 Incidentally, the operator 6 in the above embodiment may be an industrial robot for loading operation. In this case, when the warning means 12 is actuated to provide a warning, the operation of the robot can be stopped. In addition, if an abnormal situation takes place in which a workpiece slips off the gripping hands of the robot for example, the loading operation of the robot can be modified or replaced by a human operator with the substantially same results as obtainable with the embodiment of Figs. 1 through 6. In this manner, improper loading, which could result from an abnormality in operation of the robot, can be avoided.

25 As described in the foregoing, according to the present invention, an operator is able to load onto a pallet a required number of workpieces for each type thereof in a predetermined pattern in accordance with the visible instructions displayed at the display means. Further, the loaded workpieces are also displayed at the display means so that if there is an error in loading, the operator is warned of such an error. Accordingly, with the apparatus of a simple construction, the operator is able to perform a loading operation with ease and efficiency, and improper loading can be avoided.

30 45 Claims

1. A loading management apparatus for managing the loading of a plurality of types of workpieces (1a-4a) onto a pallet (5), said apparatus comprising:

35 instruction means (11) for preparing a workpiece loading pattern based on given loading information and for providing a loading instruction in the form of a visual image based on the thus prepared workpiece loading pattern;

40 loading condition detecting means (8) for detecting the condition of the workpieces which are loaded onto the pallet according to the loading instruction of said instruction means;

5	a control unit (9) being operable to determine whether there is disagreement between the loading instruction of said instruction means and the loading condition of the workpieces detected by said loading condition detecting means; and	die ferner eine Anzeigeeinrichtung (10) aufweist, um den Ladebefehl der Befehlseinrichtung anzuzeigen, so daß ein Bediener (6) die Werkstücke auf die Palette laden kann, während er gleichzeitig auf die visuelle Abbildung des an der Anzeigeeinrichtung angezeigten Ladebefehls sieht.
10	warning means (12) being operated by said control unit to provide a warning of disagreement when said control unit determines that there is disagreement between the loading instruction and the detected loading condition.	3. Lademanagementvorrichtung nach Anspruch 2, wobei die Anzeigeeinrichtung ferner wirksam ist, um den von der Ladezustandsdetektoreinrichtung detektierten Ladezustand der Werkstücke während der Zeit anzuzelgen, in der der Ladebefehl von der Befehlseinrichtung abgegeben wird.
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Recommendations

1. **Appareil de commande de chargement pour diriger le chargement d'une pluralité de types de pièces à usiner (1a-4a) sur une palette (5), ledit appareil comprenant :**

des moyens d'instruction (11) pour préparer un schéma de chargement de pièces à usiner sur la base d'une information de chargement donnée et pour fournir une instruction de chargement sous la forme d'une image visuelle basée sur le schéma de chargement de pièces à usiner ainsi préparé;

des moyens de détection de condition de chargement (8) pour détecter la condition des pièces à usiner qui sont chargées sur la palette conformément à l'instruction de chargement dudit moyen d'instruction;

une unité de commande (9) pouvant être actionnée pour déterminer s'il existe un manque de concordance entre l'instruction de chargement provenant desdits moyens d'instruction et l'état de chargement des pièces de travail détecté par lesdits moyens détectant la condition de chargement; et

des moyens avertisseurs (12) pouvant être actionnés par ladite unité de commande afin de signaler un manque de concordance lorsque ladite unité de commande détermine qu'il y a un manque de concordance entre l'instruction de chargement et l'état de chargement détecté.
2. **Appareil de commande de chargement selon la revendication 1, comprenant en outre des moyens d'affichage (10) pour afficher l'instruction de chargement desdits moyens d'instruction de sorte qu'un opérateur (6) peut charger les pièces à usiner sur la palette, tout en regardant l'image visuelle de l'instruction de chargement affichée sur lesdits moyens d'affichage.**
3. **Appareil de commande de chargement selon la revendication 2, dans lequel lesdits moyens d'affichage (10) sont des moyens d'affichage à écran liquide.**

fichage fonctionnant en outre pour afficher l'état de chargement des pièces à usiner détecté par lesdits moyens de détection de condition de chargement pendant le temps pendant lequel l'instruction de chargement est en train d'être fournie par ledit moyen d'instruction. 5

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FIG. 1

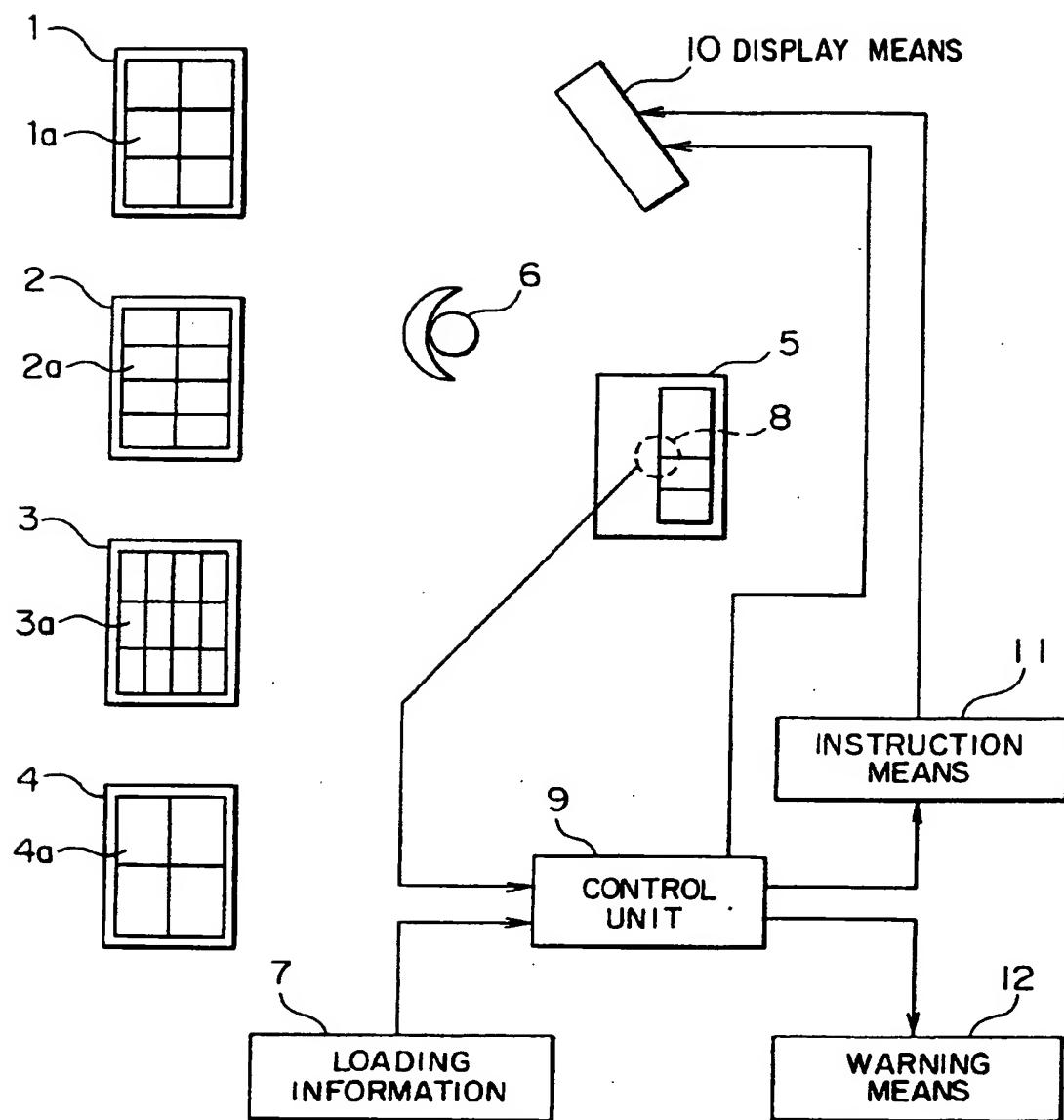


FIG. 2

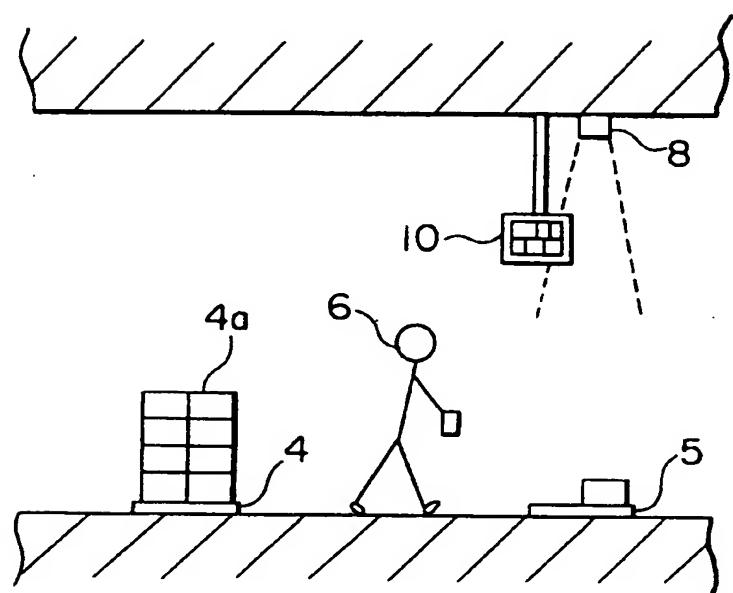


FIG. 3

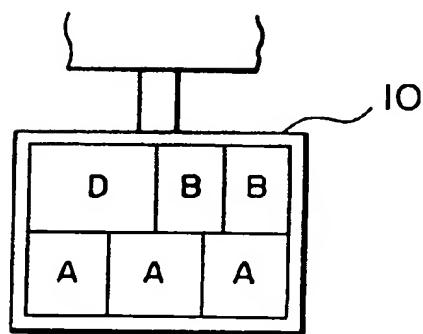


FIG. 4

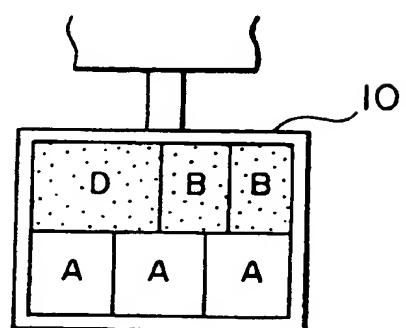


FIG. 5

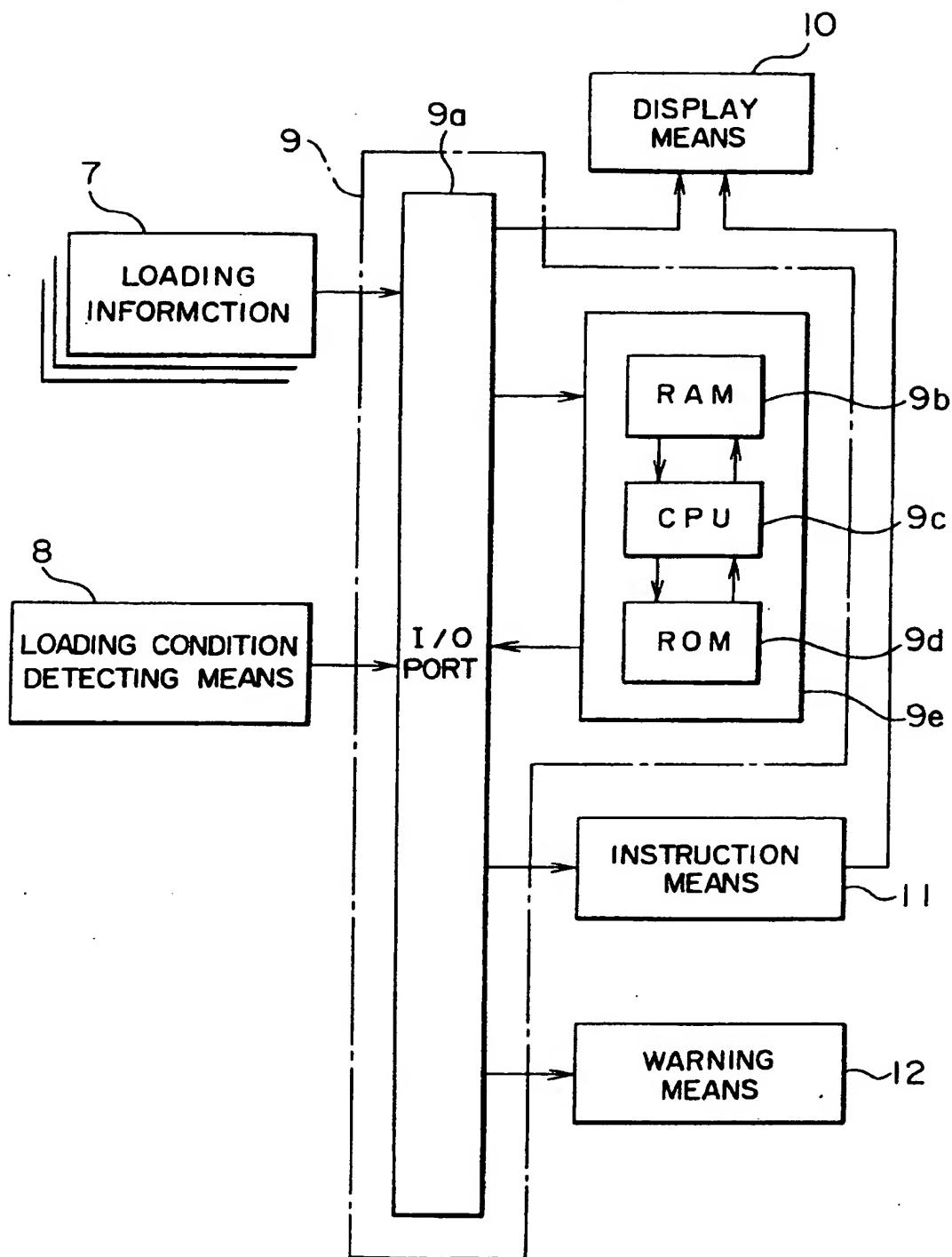


FIG. 6

